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COMIREX-D-33.1/1

26 April 1968

MEMORANDUM FOR: Committee on Imagery Requirements and
Exploitation

SUBJECT: EXRAND Objectives for Research and
Development in Imagery Exploitation

1. The Exploitation Research and Development Subcommittee (EXRAND) has prepared the attached outline of objectives for the 1970-1980 time period. It is the intention of EXRAND to continue the refinement of the objectives with the assistance of an R&D oriented group, under the guidance of the Chairman, EXRAND, to be selected by EXRAND members. Prior to this step it is requested that COMIREX study the objectives and provide EXRAND with firm guidance on the objectives as defined in the attached document, on the rationale given for pursuing the objectives, and any critique it may have as to the approach outlined by EXRAND. Recommendations as to how objectives should be reoriented as well as additional objectives should also be a part of the COMIREX consideration.

2. The Chairman, EXRAND, has noted that the attached objectives have not been completely staffed through all elements of the agencies represented on EXRAND. COMIREX may have specific questions on the extent of the staffing and may have recommendations on further work needed along these lines. [] has noted, however, that in previous and preliminary draft stages the objectives have been distributed quite extensively in certain areas and have indeed provided unofficial guidance for projects for the 1969-1974 budgets. The NPIC Project Evaluation Committee also had drafts available prior to its review of the R&D portion of the NPIC FY 1969 operating budget.

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3. This paper will be on the agenda for discussion at COMIREX at an early date.




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Executive Secretary

Committee on Imagery Requirements and Exploitation

Attachment

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4	DIA 
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9, 10	OACSI TCO
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PROPOSED
NATIONAL IMAGERY EXPLOITATION RESEARCH AND
DEVELOPMENT OBJECTIVES

A. General Objective

1. Under the provisions of DCID 1/13, the Exploitation Research and Development Subcommittee (EXRAND) of the USIB Committee on Imagery Requirements and Exploitation (COMIREX) has prepared this Objectives Document for the 1970-1980 time period to unify and guide the Research and Development activities of those facilities participating in the National Tasking Plan.

2. The intelligence community must insure that the cost of supplying the information needed to support National policy decisions is held to a minimum. This creates a situation with many potential tradeoffs between accuracy, speed, completeness, need, capability and cost. Exploitation efficiency is the key to the appropriate mix of these elements. Within this objective, the following principles must be directly addressed in exploitation R&D plans:

a. Accuracy and reliability near one-hundred percent.

b. Speed of response equal or faster than the collection time.

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c. Completeness sufficient to answer all reconnaissance EEI's.

d. Clear understanding of man-machine relationships in visual perception and in the extraction of information from imagery

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B. Specific Objectives

1. High Volume, Large-Scale Imagery Exploitation

a. Objective: Develop imagery exploitation techniques and related equipment which will provide an efficient and timely capability for exploiting great volumes of large-scale imagery which will result from future long focal-length, narrow viewing-angle collection systems.

b. Rationale: The developers of future collection systems have indicated that the trend in improving reconnaissance systems will continue in a direction which will produce increasingly large-scale, narrow-angle imagery rather than extremely high resolution, very small-scale imagery. The result of this trend is that the volume of imagery to be exploited will increase in direct proportion to the increases in focal length and the reduction in the angle of view. These huge quantities of large-scale imagery present severe problems to efficient, timely

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exploitation processes. Thus, it will be necessary to develop significantly new approaches to exploitation techniques, including the automation of major portions of the tasks involved, if any reasonable available force of image interpreters are to be able to exploit these large volumes of imagery in an efficient and timely manner.

2. National Multispectral Information Data Base

a. Objective: To develop and maintain an advanced integrated multispectral data base system to support the production of a timely, accurate, collated finished intelligence product at the national and departmental levels throughout the 1970's.

b. Rationale: Substantial improvement in the timeliness and efficiency in the future imagery exploitation system requires real-time accessibility to both data and multispectral imagery-retrieval records to insure effective exploitation support of national and departmental needs.

3. Duplicating Equipment and Emulsions

a. Objective: To provide easy to use duplicating materials and related equipment.

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(1) Continue development of film emulsions with emphasis on reversal materials with quality of image recording equal to or better than emulsions in use today.

(2) Develop duplication equipment for use at the imagery exploitation station. This equipment must be capable of producing film or paper reproductions at contact or enlarged scale from the original. Equipment must be designed for ease of operation by the image interpreter to permit rapid selection and reproduction of selected imagery and reduce material handling problems.

(3) Develop non-silver duplicating media for all major aspects of image duplication including line and continuous tone. This material must be equal in performance to silver materials and less costly to utilize. Dry processing is an important collateral objective.

b. Rationale: The conventional silver halide continuous-tone reproduction process, now universally used,

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requires considerable time, cost, specialized manpower, complex equipment, and extensive logistical support. Prior and current R&D studies directed toward the development of a rapid-access, dry photographic material have produced emulsions with very high resolutions and require only heat for development. This development produces positive images from negative, and vice versa. Studies indicate that a practical reversal reproduction system can be developed which can produce an image with the same polarity as that of the original.

4. Exploitation of Imagery in Both Chip and Roll Form

a. Objective: Develop systems to produce reference quality chips rapidly and efficiently and to produce exploitation quality chips at slower but adequate speeds; develop improved techniques and equipment for the efficient and timely use of roll film with or without both reference and exploitation quality chips.

b. Rationale: Trends in image exploitation operations indicate that, within the foreseeable future, there will be valid and important uses for imagery in both

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roll and chip form. Thus, the R&D effort must provide adequate techniques and equipment for the most efficient production and use of both chips and roll film. The very circumstances of when and how best to utilize each of these imagery forms must be investigated. Roll film may maintain a position of importance in initial screening, scanning, and in the early phases of exploitation; if so, then the techniques and equipment for producing, viewing, handling and storing it must be improved and further automated. The place of chips as a reference material appears to be assured, thus, the processes of rapidly and efficiently producing medium quality chips, storing and retrieving them, and displaying them for comparative use in relation to other imagery must be improved and automated. If high quality, exploitation type chips are to find a place in improving and increasing efficiency of detailed analysis, breakthroughs in the technology of reproducing imagery without loss and in a reasonably efficient manner must be made. It appears that the best possibilities for improving efficiency and timeliness in image exploitation lie in significant improvements in the

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interrelated use of all of these types of imagery records.

It also appears that, regardless of the final size of chips which result from the R&D Program, the CODIB concept of proportionality should receive serious consideration.

5. Target Change Detection

a. Objective: Develop devices and techniques which will assist the imagery analyst in detecting significant changes to a target which has been photographed repeatedly.

b. Rationale: The increasing volume of reconnaissance materials demands an acceleration in the exploitation process. One means of acceleration is to provide the imagery analyst with semi-automatic aids which will assist him by performing routine, redundant, and time consuming tasks such as the detection of changes to a previously interpreted target.

6. Semi-Automatic Reporting

a. Objective: Develop an effective and efficient interface with the National Base of Imagery Derived Information (NBIDI) for use by the image interpreter.

b. Rationale: Imagery, line drawings and sketches will be included in third phase reporting into the NBIDI. Formats

and information content for third phase reporting are now being developed by the Exploitation Subcommittee and National Imagery Data Base Working Group. These formats will be designed primarily to be human-readable but they will also be, to the extent practical, machine-processable for reporting through computer-based files. Effective interface with the NBIDI by the image interpreter for inputs must be provided.

7. Near Real-Time Data Extraction System

a. Objective: The objective is to provide the equipment and techniques for a near real-time exploitation to efficiently and accurately exploit near real-time imagery inputs in the 1970's.

b. Rationale: The potential uses of near real-time imagery acquisition, transmission and delivery dictate the need for major automation efforts to achieve increased imagery exploitation efficiency in all phases of the future operational exploitation process.

8. Image Manipulation and Transmission

a. Objective: Develop devices and techniques which will fully exploit target signature transmissions, including manipulation of the electronic signals.

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- (1) Development of recorder-processor viewer (RPV) with ultra-high resolution output.
- (2) Development of equipment to manipulate and analyze the electronic target signature data.
- (3) Development of broad band, high frequency (200-500 megahertz) recording devices.

b. Rationale: Future reconnaissance systems which are now in the planning stage are being designed to utilize electro-optical systems with real-time or near real-time transmission of target signature data to the reconnaissance interpretation facility. Real-time or near real-time transmission of electronic signals will insure immediate availability of intelligence data for Cold War crisis management. Since the target data will be transmitted in an electrical form, considerable information of intelligence value may be gained by electrically manipulating the signals to enhance and identify the target signature data.

9. Multi-Spectral Exploitation

a. Objective: Develop the equipment and techniques needed to fully exploit the spectral signature of targets. Exploratory and advanced development efforts are required.

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to produce equipment for use in the 1970's to give the necessary capabilities to fully exploit the multi-spectral imagery.

b. Rationale: High-altitude reconnaissance has used silver halide photography almost exclusively to record spatial image variations. However, this photography produces imagery that represents radiance fluctuations as averaged in the emulsion over a wide wavelength band. Such photography ignores a characteristic of the object that may contain as much information as the spatial and tonal variations - its spectral reflectance or emission. Multi-spectral collection and exploitation techniques may make it possible to detect and identify objects that may otherwise go unnoticed.

10. Coding Imagery

a. Objective: To devise a system and recommend techniques and procedures to allow machine correlation between various imagery records and ground coordinates.

b. Rationale: The speed and accuracy of first and second phase exploitation may be increased through the use of a technique to provide rapid correlation of different imagery records with each other and with ground and map coordinates. This coding system may be utilized to correlate

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Inertial Navigation Systems, previous coverage, ephemeris data, magnetic tape recording, Elint data and other sensors.

11. Film Base Reclamation and Silver Recovery

a. Objective: Develop or select efficient standard systems for the disposal of large volumes of classified photographic film materials, the reclamation of the film base and the recovery of silver from the film emulsion.

b. Rationale: U.S. intelligence collection systems produce an increasingly high volume of imagery which is normally duplicated in multiple copies on materials having ester polyester, cellulose acetate butyrate, or triacetate bases. When this imagery becomes obsolete or further storage is impractical due to space limitations, the residual materials must be reclaimed in a manner which eliminates any chance of security compromise. Existing disposal devices and techniques are considered to be inefficient and, in general, lack capability to recover silver from the film emulsion.

12. Mensuration

a. Objective: Develop equipment and procedures for imagery measurement to accommodate projected imagery collection systems with emphasis on speed and simplicity of operation.

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b. Rationale: Mensuration, at all levels of accuracy, is an integral part of interpretation and should be performed by both the Image Interpreter and the Photogrammetrist. Routine measurements for identification and analysis are a necessary part of the inductive reasoning process performed by the interpreter, while measurements for reports having calculated statistical accuracies must be derived by specialists in mensuration.

13. Stereo Viewing

a. Objective: Develop display device/suitable for viewing large quantities of black and white and color stereo imagery, in a wide range of formats and scales, and capable of accommodating the distortions inherent in projected collection systems. Emphasis should be placed on optical efficiency and simplicity and reliability of operation.

b. Rationale: Stereo viewing is vital to imagery interpretation and mensuration. Complex or "busy" images, such as camouflaged targets, industrial plants, construction sites, etc., benefit most from stereo viewing but most targets can be analyzed and identified satisfactorily through perspective and shadow relationships in a monocular mode. The real need,

therefore, is to have a stereo viewing capability which can be quickly brought into use when monocular relationships in the image fail to form accurate spatial relationships in the mind of the interpreter. Accurate vertical measurements, of course, require conjugate stereo images and mensuration viewers in order to perform the necessary geometric solutions.

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